table kingdom, these, too, would be referred without hesitation either to the one or to the other, some passing to the former and others to the latter. The group of the Protista is thus at best but a provisional one, based partly on our ignorance of the structure and life-history of the beings which compose it, and partly on our inability to assign to the animal its essential difference from the plant. Haeckel, however, has done well in specially directing attention to it, and in his admirable researches on many of the organisms which he has thus grouped together he has largely contributed to our knowledge of living forms.

I have thus dwelt at considerable length upon this important paper of Haeckel's, because I think that it not only brings out in a clear light the essential features of infusorial structure and physiology as demonstrated by recent research, but that it goes far to set at rest the controversy regarding the unicellularity and multicellularity of the Infusoria.

Balbiani has quite recently published a very interesting account of the remarkable Infusorium long ago described by O. F. Müller under the name of *Vorticella nassuta*, and more recently taken by Stein as the type of his genus Didinium.

The animal, which is somewhat barrel-shaped, with an anterior and a posterior wreath of cilia, has one end continued into a proboscis-like projection which carries the oral orifice on its summit, while an anal orifice is situated on the point diametrically opposite to this. There is a very distinct cuticle, though the rest of the cortical layer is very thin, and can scarcely be optically distinguished from the internal parenchyma, which exhibits manifest currents of rotation. These flow in a continuous sheet along the walls from the anal towards the oral side, and on arriving at the mouth turn in towards the axis and then flow backwards along this until they complete the circuit by once more reaching the anal side of the body. No trichocysts are developed in the walls of the body. The contractile vesicle is large, and is situated near the anal end ; it presents very distinct pulsations, and Balbiani is disposed to believe in a communication between it and the exterior.

During the act of digestion a tubular cavity can be seen running through the axis of the body, and connecting the oral and anal orifices. This is regarded by Balbiani as a permanent digestive canal. The post-oral or pharyngeal portion of this tube possesses a very remarkable feature, namely, a longitudinal striation caused by rigid rod-like filaments which are developed in its walls, and which can be easily detached and isolated by pressure or by the action of acetic acid. They then resemble some common forms of the raphides developed in the cells of plants. The function of these rods becomes apparent when the animal is observed in the act of capturing its prey. The Didinium is eminently voracious and carnivorous, and when in pursuit of other living Infusoria, such as Paramecium, the prey may be seen to become suddenly paralysed on its approach. A careful examination will then show that the Didinium has projected against it some of its pharyngeal rods, and to the action of these bodies the arrest of motion is attributed. A curious cylindrical tongue-like organ is now projected from the mouth towards the arrested prey, to which it becomes attached by its extremity. By the retraction of this tongue the prey is now gradually withdrawn towards the mouth, engulphed in the distended pharynx, and pushed deeper and deeper into the axial canal, where it is digested, and the effete matter ultimately expelled through the anus.

From all this Balbiani concludes against the unicellular doctrine. He sees in the axial cavity a permanent alimentary canal, and in the surrounding parenchyma a true perigastric space filled with a liquid which corresponds with the perigastric liquid of the polyzoa and of many other lower animals. He is not, however, disposed to make too broad a generalisation, and to insist on the presence of an alimentary canal distinct from a body cavity in all the other Infusoria. Here, however, he falls in with the views of Claparede and Lachmann and of Greeff, and maintains that as a rule the digestive and body cavity in the Infusoria are confounded into a single gastrovascular system.

Independently, however, of the untenableness of the conception of a united digestive and body cavity, it does not appear to me that Balbiani makes out any case against the unicellularity of the Infusoria. He admits that except in the pharyngeal and anal portion there is no evidence of a differentiated wall in his so-called digestive canal, and even though it be conceded that the middle portion of this canal constitutes a permanent cavity in the parenchyma, it would not differ essentially from other lacunæ permanently present in the protoplasm of many undoubtedly unicellular organisms. It has been already remarked that a communication between these lacunæ and the external medium is paralleled in many simple cells, and these external communications in Didinium present no feature essentially different.

The pharynx appears to be bounded by an inflection of the cortical layer, and I believe we may regard the rod-like corpuscles here present as a peculiar modification of the trichocysts which in many other Infusoria are developed in the cortical layer of the body. The projectile tongue-like organ is one of the most remarkable features of Didinium ; we must know more, however, than Balbiani has told us of it, before we can decide on its real import. It is not improbably a pseudopodial extension of the protoplasm.

Balbiani has followed the Didinium through the process of transverse fission. This is preceded by the formation of two new wreaths of cilia, between which the constriction and division takes place, each half previously to actual separation developing within it such parts as it had lost in the act of division. The only part which in this act becomes divided between the two resulting animals is the nucleus. The so-called nucleolus was not seen by Balbiani, and though he observed two individuals in conjugation by their opposed oral surfaces, he never witnessed anything like the formation of eggs or embryos.

I believe I have now laid before you the principal additions which during the last few years have been made to our knowledge of the Infusoria. But though it will be seen that the labourers in the special field of microscopical research, to which I have confined this address, have been neither few nor deficient in activity, it must not be imagined that the subject has been exhausted, or that many questions, more especially such as relate to development, do not yet await the results of future investigations for their solution.

PRIZES OF THE FRENCH ACADEMY

AS our readers are aware, the Paris Academy of Sciences holds at the end of December each year a solemn meeting for hearing *éloges* of the departed members, and delivering prizes to the most deserving essayists. But owing to the calamity of the war the prizes for 1873 were distributed in the end of 1874, and the prizes for 1874 remained undistributed. An extraordinary solemnity was celebrated on June 21, for the distribution of the 1874 prizes, and henceforth we hope nothing will prevent the Academy fulfilling its yearly duties with punctuality. M. Bertrand, the new perpetual secretary, read an essay on the life and works of M. Élie de Beaumont, his predecessor in the office. Since Abbé Duhamel, the first of these perpetual secretaries, died, this has been the constant practice. So Abbé Duhamel was praised by Fontenelle, Fontenelle by Fouchy, Fouchy by Condorcet, &c. &c. But M. Élie de Beaumont did not produce any *éloge* on Arago ; it will be the next duty M. Bertrand will have to perform, and a very attractive one it is. The following are the results of last year's competition as announced at the meeting :—

1. Grand Prize in the Mathematical Sciences for a Mathematical Theory of the Flight of Birds was not awarded, though 2,000 francs were given to M. Penaud, the author of one of the memoirs, and an "encouragement" of 1,000 francs to the two authors of another memoir, MM. Hureau de Villeneuve and Crocé-Spinelli.

2. This was also the case with the Grand Prize in the Physical Sciences, the subject being Fecundation in Mushrooms. The value of the prize was, however, divided between the authors of two memoirs, viz., MM. Maxime Cornu and Ernest Rose, and M. Sicard.

3. The Poncelet Prize in Mechanics was awarded to M. Bresse, Engineer-in-chief des Ponts et Chaussées, for his work entitled "Cours de Mécanique Appliquée," and particularly for the great progress shown in the part devoted to the resistance of materials.

4. The Montyon Prize in Mechanics to M. Peaucellier, Lieutenant-Colonel of Engineers, for his researches on the transformation of alternate rectilineal motion into alternate circular motion.

5. The Plumey Prize to M. Joseph Farcot for his *servo-moteur*, or *moteur-asservi*, an apparatus which renders the action of the rudder more certain and more easy.

6. The Lalande Prize in Astronomy is a sextuple one, and was divided among MM. Mouchez, Bouquet de la Grye,

Fleuriais, André, Héraud, and Tisserand, as a reward for their observations of the Transit of Venus.

7. The Montyon Prize in Statistics was awarded to M. de Kertanguy, and honourable mention was made of MM. de St. Genis and Loua.

8. The Jecker Prize was divided into two, 3,000 francs being awarded to Prof. Reboul of Besançon for his work on the Ethers of Glycide and on the Hydrocarburets; and 2,000 francs to M. Bouchardat for his researches on the Ethers of Mannite and of Dulcite.

9. The Desmazières Prize was awarded to M. J. de Seynes for his study of many cryptogamic plants belonging to the genus *Fistulina*, and especially of *F. hepatica*.

10. The Fons Mélicoq Prize was divided by way of encouragement between M. Calley, author of a catalogue of vascular plants of the Department of Ardennes, and MM. Eloi de Vicq and Blondin de Brutelette, authors of a Catalogue Raisonné of vascular plants of the Somme.

11. The Thore Prize in Anatomy and Zoology, to M. Auguste Forel for his work "Les Fourmis de la Suisse."

12. The Bréant Prize of 100,000 francs always offered for the treatment of cholera was not awarded. A reward of 3,500 francs was accorded to M. Ch. Pellarin for his studies on the character and modes of transmission of cholera. For similar studies a reward of 1,500 francs was given to M. Armieux.

13. The Montyon Prize in Medicine and Surgery was divided as follows:—2,400 francs each to MM. Dieulafoy, Melassez, and Méhu; honourable mention and 1,000 francs to MM. Béranger-Féraud, Létiévant, and Péter.

14. Two Montyon Prizes of equal value, in Experimental Physiology, were awarded, one to MM. Arloing and Tripier for their experimental research on the conditions of persistence and sensibility in the peripherical end of divided nerves; and the other to M. Sabatier for his studies on the heart and the central circulation in the Vertebrata.

15. The proceeds of the Tremont Prize for 1873-4-5 were awarded to Prof. Achille Cazin.

16. The Gegner Prize was given to M. Gaugain to aid him in his researches in electricity and magnetism.

17. The Laplace Prize, consisting of a collection of the works of Laplace, was bestowed upon M. Badoureau, pupil of the first rank, 1874, in the École Polytechnique, and student in the Ecole des Mines.

Several prizes were not awarded.

The following are the subjects proposed for the next competition:—

1. Grand Prize in the Mathematical Sciences for 1876:—To deduce from a new and thorough examination of ancient observations of eclipses the value of the apparent secular acceleration of the mean movement of the moon; to fix the limits of exactness which the determination bears. Value of the prize, 3,000 francs.

2. Another Grand Prize of the same value in the Mathematical Prizes for 1876:—Theory of the singular solutions of equations for partial derivatives of the first order.

3. Grand Prize of 3,000 francs in the Mathematical Sciences for 1877:—Application of the theory of elliptic or Abelian transcendentals to the study of algebraic curves.

4. Grand Prize of 3,000 francs in the Physical Sciences for 1876:—To investigate the changes which take place in the internal organs of insects during complete metamorphosis.

5. Another Grand Prize of 3,000 francs in the Physical Sciences for 1876:—Investigation into the mode of distribution of marine animals on the coast of France.

6. Grand Prize of 3,000 francs in the Physical Sciences for 1877:—Comparative study of the internal organisation of various Edraiophthalmous Crustaceans which inhabit the European seas.

7. Extraordinary Prize of 6,000 francs on the application of steam to war-ships.

8. The Poncelet Prize (annual), intended to reward the work most useful to the progress of the mathematical sciences, pure or applied, which will have been published during the last ten years. Value 2,000 francs, with a copy of the complete works of Poncelet.

9. The Montyon Prize (annual) of 427 francs:—Agricultural or Industrial Mechanics.

10. The Plumey Prize (annual) of 2,500 francs:—Improvements in steam-engines.

11. The Dalmont Prize (triennial) of 3,000 francs, to be awarded in 1876, is confined to engineers "des ponts et chaussées."

12. The Bordin Prize of 3,000 francs:—To find a means of doing away with, or at least of seriously diminishing the inconvenience and the dangers which arise from the products of combustion issuing from the chimneys of railway-engines and of steamboats, as well as in towns from the proximity of furnaces.

13. The Lalande Prize (annual) of 542 francs is offered to the work most useful to Astronomy.

14. The Damoiseau Prize (the value not indicated):—To review the theory of the Satellites of Jupiter; to examine the observations and deduce from them constants, particularly that relative to the speed of light; finally, to construct special tables for each satellite.

15. Vaillant Prize (biennial) of 4,000 francs, to be awarded in 1877, to the best work on the planetoids.

16. The Valz Prize (annual) of about 500 francs, to be awarded in 1877 to the author of the best charts relating to the region of the invariable plane of the solar system.

17. The Bordin Prize of 3,000 francs:—To determine the temperature of the solar surface.

18. The Montyon Prize (annual) of 453 francs:—Statistics of France.

19. One or more Jecker Prizes (annual) for works on Organic Chemistry.

20. The Barbier Prize (annual) of 2,000 francs, for a medical, surgical, or pharmaceutical discovery.

21. The Alhumbert Prize of 2,500 francs, to be awarded in 1876:—The method of nutrition of mushrooms.

22. The Desmazières Prize (annual) of 1,600 francs, for the best work on cryptogamy, published in the year which precedes that of the competition.

23. The Fons Mélicocq Prize (triennial) of 900 francs, to be awarded in 1877 to the author of the best botanical work on the North of France.

24. The Thore Prize (annual) of 300 francs, intended to reward alternatively researches on the cellular cryptogams of Europe, or on the habits and anatomy of an insect.

25. The Bordin Prize of 1876, of 3,000 francs:—To study comparatively the structure of the teguments of the seed in angiospermous and gymnospermous plants.

26. Another Bordin Prize for 1877, of 3,000 francs:—To study comparatively the structure and the development of the organs of vegetation in the Lycopodiaceæ.

27. The Morogues Prize (quinquennial), value not indicated, to be awarded to the author of the best work on Agriculture.

28. The Savigny Prize of about 1,000 francs is intended to reward a young zoological traveller.

29. The Bréant Prize of 100,000 francs, offered to whoever discovers the means of preventing Asiatic cholera or the causes of that malady.

30. Montyon Prizes (annual) in Medicine and Surgery.

31. Serres Prize (triennial) of 7,500 francs, for the best work on general embryogeny applied as far as possible to physiology and medicine.

32. Godard Prize (annual) of 1,000 francs, for the best memoir on the anatomy, physiology, or pathology of the genito-urinary organs.

33. Montyon Prize (annual) of 764 francs, in experimental physiology.

34. One or more Montyon Prizes (annual) in the industrial arts.

35. Trémont Prize (annual) of 1,100 francs, intended to encourage any *savant*, *artiste*, or mechanician who may be thought worthy.

36. The Geger Prize (annual) of 4,000 francs, "to support a poor *savant* who has signalised himself by important researches."

37. The Cuvier Prize (triennial) of 1,500 francs will be awarded in 1876 to the best work on the animal kingdom or on geology which will have appeared in the years 1873-75.

38. The Delalande-Guérineau Prize (biennial) of 1,000 francs, to be awarded in 1876 to the French traveller or *savant* who will have rendered the best services to France or to science.

39. The Laplace Prize (annual), consisting of a collection of the complete works of Laplace, to the pupil of first rank leaving the École Polytechnique.

The limit for the competitions for the above prizes is the 1st of June of the year in which the prize is to be awarded.